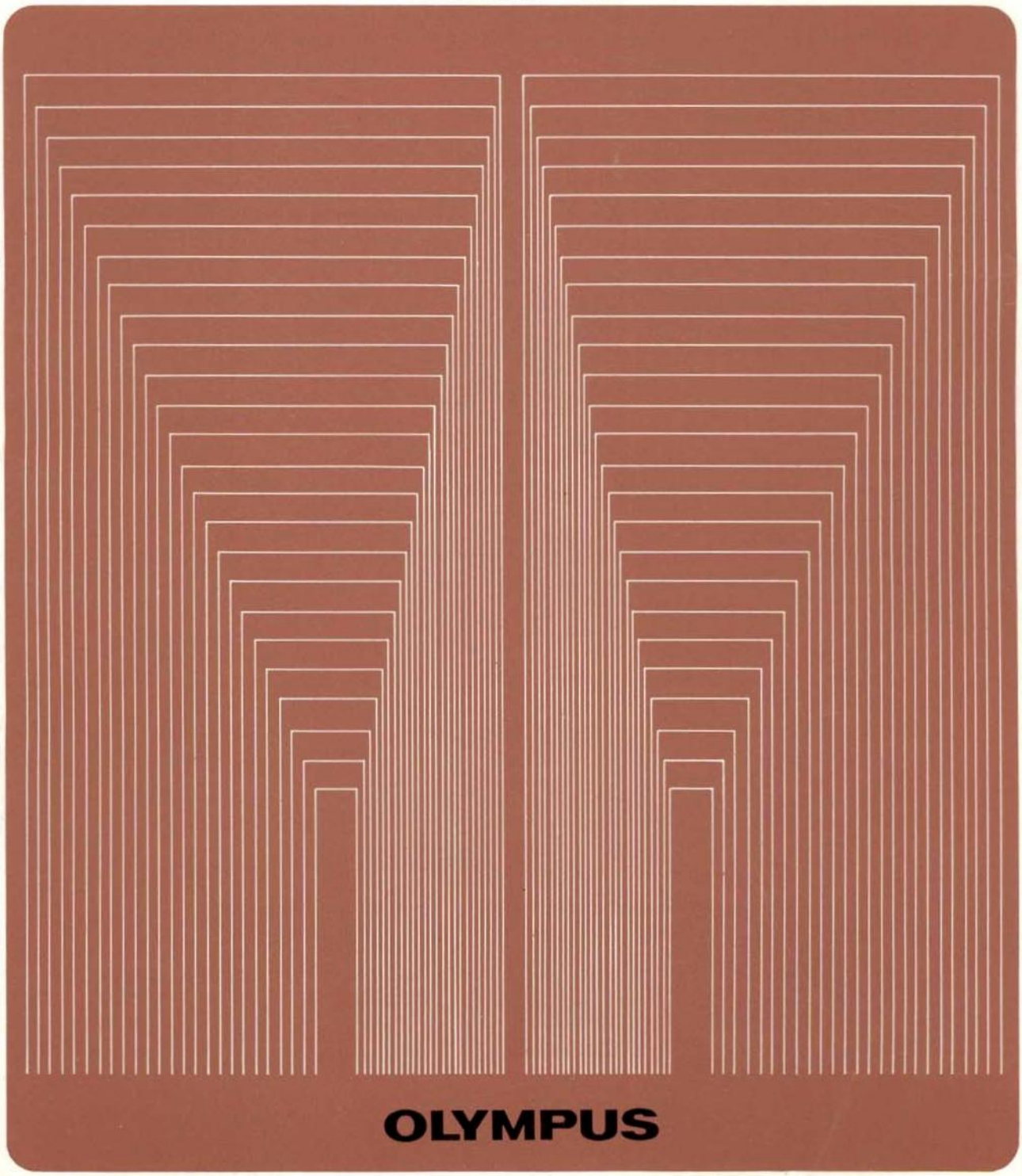
OLYMPUS POLARIZING MICROSCOPE

INSTRUCTION MANUAL

MODEL CHA-P



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This instruction manual has been written for the use of the Olympus Polarizing Microscope Model CHA-P. It is recommended to read the manual carefully in order to familiarize yourself fully with the use of the microscope on the polarizing attachment so that you can obtain the best performance and effectiveness.

IMPORTANT

Observe the following points carefully:

■ **Operation**

1. Always handle the microscope with the care it deserves, and avoid abrupt motions.
2. Avoid exposure of the microscope to direct sunlight, high temperature and humidity, dust and vibration.
   (If the microscope is used in ambient temperature higher than 40°C (104°F), it may impede its proper function.)
3. Only use the tension adjustment ring for altering the tension of the coarse adjustment. Do not twist the two coarse adjustment knobs in the opposite directions simultaneously, which might cause damage.
4. Ascertain that the line voltage selector switch on the base plate is set to conform with the local mains voltage.

■ **Maintenance**

1. Lenses must always be kept clean. Fine dust on lens surfaces should be blown or wiped off by means of an air blower or a clean brush. Carefully wipe off oil or fingerprints deposited on the lens surfaces with gauze moistened with a small amount of xylene, alcohol or ether.
2. Do not use organic solutions to wipe the surfaces of various components. Plastic parts, especially, should be cleaned with a neutral detergent.
3. Never diassemble the microscope for repair.
4. The microscope should be stored in its container immediately after use. If this is not possible, it should be covered with a vinyl dust cover.
5. Disconnect the line cord from the AC power source before fuse replacement.

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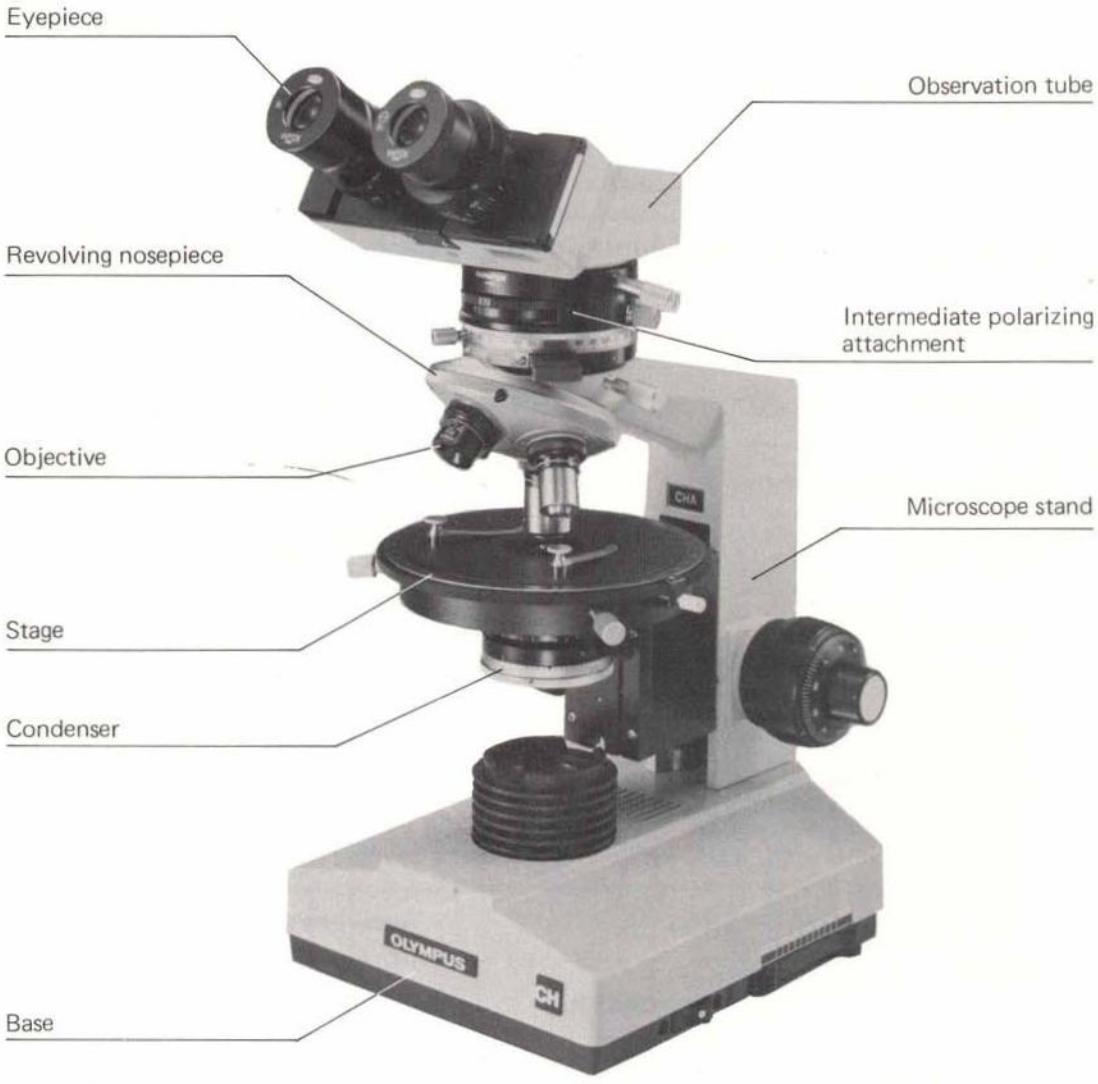
I. STANDARD EQUIPMENT

Component \ Model		CHA-P-051	CHA-P-651
Microscope stand with circular rotatable stage and quadruple nosepiece	CHA-P-F	1	1
Intermediate polarizing attachment	AH-PA	1	1
Quarter wave plate (retardation 147.3mμ)	AH-TP147	1	1
Sensitive tint plate (retardation 530mμ)	AH-TP530	1	1
Polarizing monocular tube (45°)	CH-PMO	1	0
Polarizing binocular tube (30°)	BH-PBI	0	1
Swing-out polarizing condenser	BH-POC	1	1
Halogen lamp socket	C-LSH-B	1	1
Halogen bulbs	6V10WHAL	2	2
Objectives (strain-free)	PO 4X	1	1
	PO10X	1	1
	PO40X	1	1
Eyepieces	AH-WF10X	0	1
	AH-Micro WF10X	1	1
Spare fuses (0.5A for 100-110-120V or 0.3A for 220-240V)		2	2
Vinyl dust cover		1	1

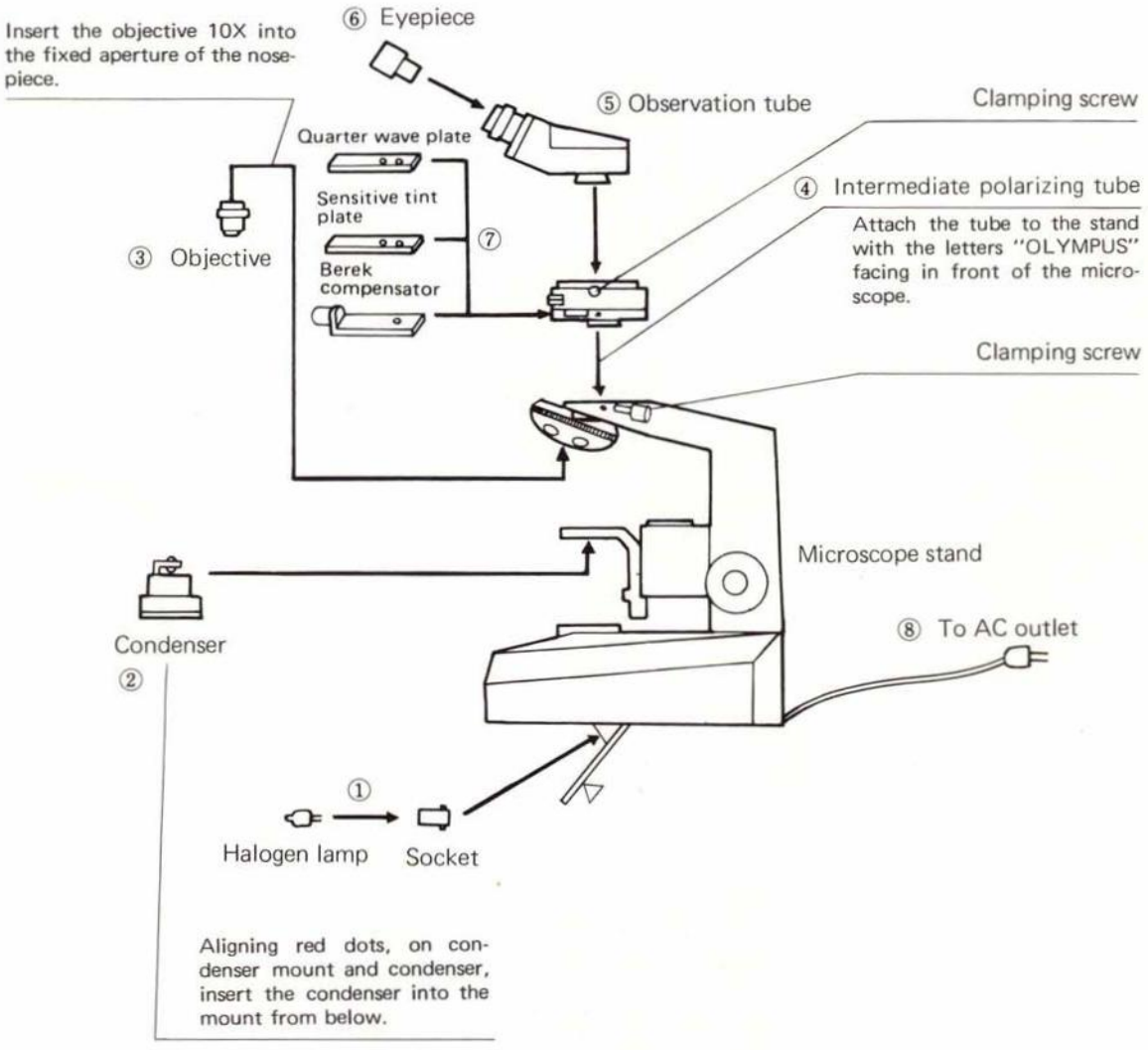
II. NOMENCLATURE

Photo: Model CHA-P-651. Model CHA-P-051 is also available by modification of some components.

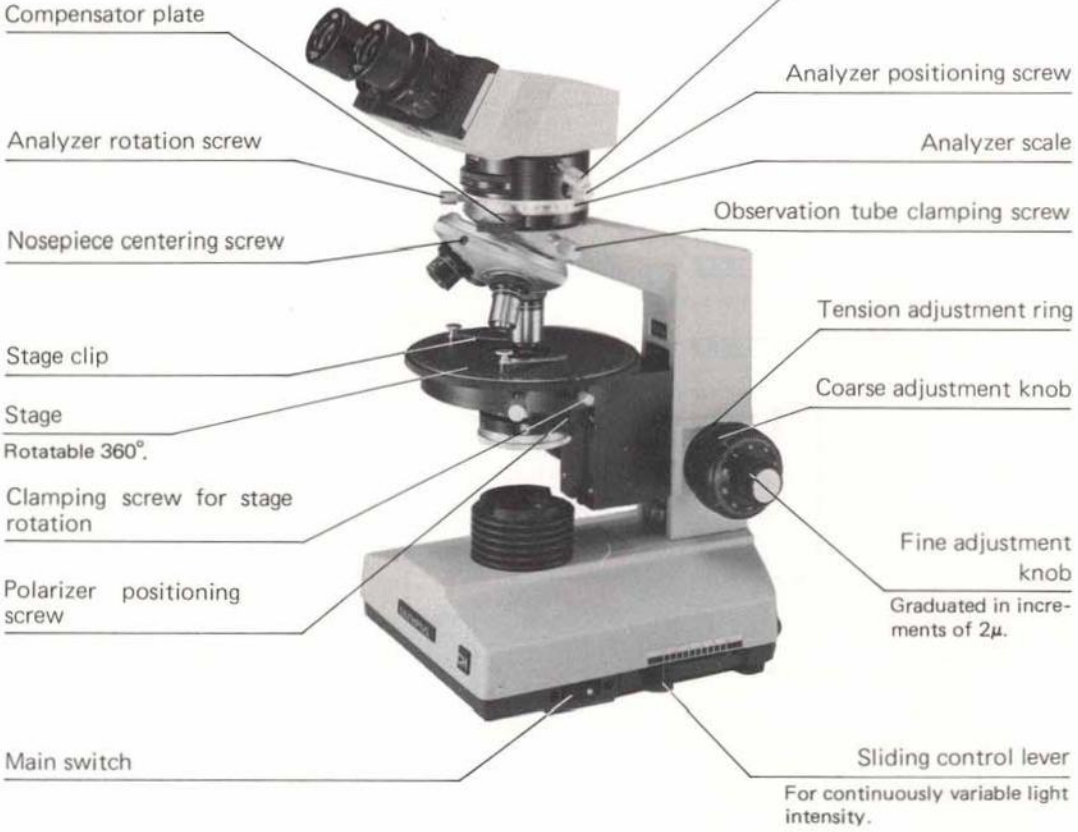


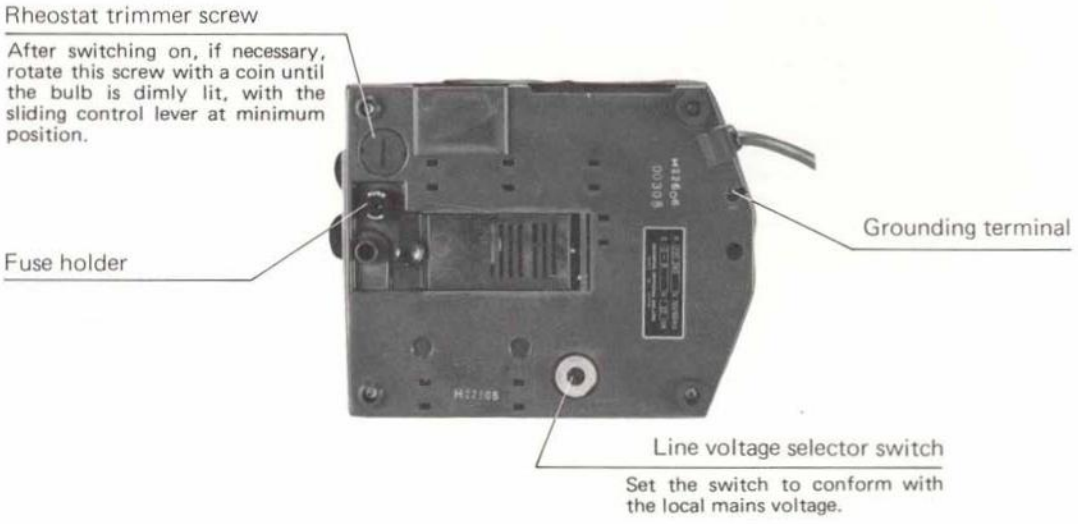
III. ASSEMBLY

The picture below illustrates the sequential procedure of assembly. The numbers indicate the assembly order of various components. Remove dust caps before mounting components. Take care to keep all glass surfaces clean, and avoid scratching the surfaces.


Insert the objective 10X into the fixed aperture of the nose-piece.
⑥ Eyepiece
⑤ Observation tube
Clamping screw
Quarter wave plate
Sensitive tint plate
Berek compensator
⑦
③ Objective
④ Intermediate polarizing tube
Attach the tube to the stand with the letters "OLYMPUS" facing in front of the micro-scope.
Clamping screw
Microscope stand
⑧ To AC outlet
Condenser
②
①
Halogen lamp
Socket
Aligning red dots, on con-denser mount and condenser, insert the condenser into the mount from below.

IV. IDENTIFICATION AND FUNCTION OF VARIOUS COMPONENTS




Rheostat trimmer screw
After switching on, if necessary, rotate this screw with a coin until the bulb is dimly lit, with the sliding control lever at minimum position.
Grounding terminal
Fuse holder
Line voltage selector switch
Set the switch to conform with the local mains voltage.

Mechanical tube length adjustment rings

Bertrand lens turret ring

Engraved letters "IN" for insertion of Bertrand lens into the light path; "OUT" for removal of the Bertrand lens from the light path.

Bertrand lens focusing ring

Condenser height adjustment knob

Stage centering screw

Automatic pre-focusing lever

Aperture iris diaphragm ring

Numerical aperture scale graduated.

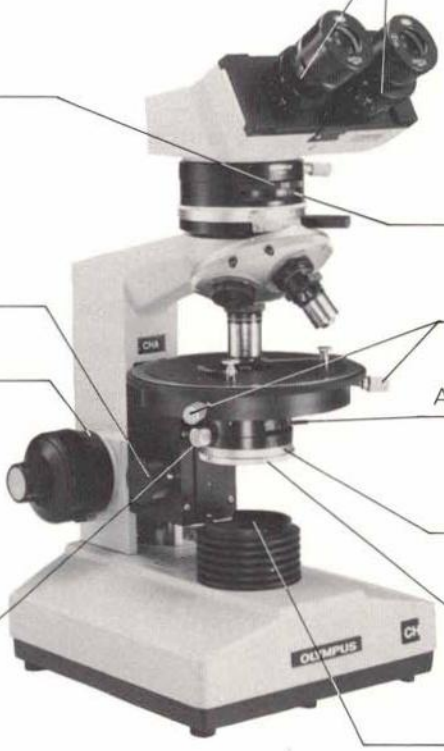
Polarizer scale

Reading to 5°.

Swing-out knob for top lens

Condenser N.A. is 0.9 (when top lens swings out N.A. is 0.25)

Polarizer rotation ring



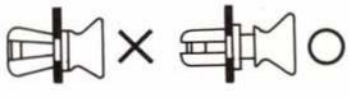
Filter mount

Accepts 45mm-diam. filters.

Bulb mount

Lamp house clamping knob

The lamp house cover can be opened by pulling down the knob; or closed by pushing it up until it snaps in place.
Before pushing, ascertain that the knob is positioned as shown in the picture right, marked with circle.



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Summary of Putting the Microscope in Operation

A. Match the line voltage selector switch to local mains voltage (see page 5).
B. Switch on the light source.
C. Adjust the trimmer screw until the bulb is dimly lit (page 7).
D. Place a specimen slide on the stage.
E. Remove the Bertrand lens and analyzer from the light path.
F. Coarse focus with the 10X objective.
G. Make interpupillary and diopter adjustments (page 7).
H. Center the stage (page 9).
I. Center objectives other than 10X (page 9).
J. Swing in the desired objective.
K. Set the condenser, analyzer and Bertrand lens correctly according to your microscopic purpose (page 10 and 11).
L. Adjust light intensity.
M. Fine focus.
N. Adjust aperture iris diaphragm (page 9).

Adjustment of Illumination System

Microscopic method	Objective	Bertrand lens	Condenser top lens
Orthoscopic observation	4X to 100X	OUT	OUT
Conoscopic observation	20X to 100X	IN	IN

For biological use, however, remove the analyzer, Bertrand lens and sensitive tint plates.

★ **Cut off this page at dotted line and put it on the wall near the microscope for use as a reminder of microscopic procedure.**

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V. OPERATION

1. Adjustment of Minimum Line Voltage

The minimum voltage required for the light source can be adjusted with the rheostat trimmer screw at the microscope base plate in accordance with the line voltage and frequency. The built-in rheostat incorporates a thyristor in its semi-conductor circuit for the following advantages:

(a) Extremely fine adjustment of light intensity can be easily achieved.

(b) Flickering of the bulb filament is eliminated and the light intensity is stabilized.

(c) Increased life expectancy of the bulb.

For adjustment of the minimum line voltage, ascertain that the voltage selector switch is set to conform with the local mains voltage, and the sliding control lever ② is positioned closest to you (low voltage), and then activate the main switch ①. If the bulb is dimly lit, the secondary voltage is correct. If it is not lit at all, rotate the rheostat trimmer screw ③ gradually with a coin, until the bulb is dimly lit; then push the sliding control lever forward in order to obtain optimum light intensity. (Fig. 1)

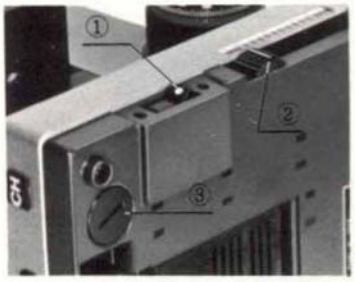


Fig. 1

2. Interpupillary Distance and Diopter Adjustments

1) Insert the eyepiece ③ with cross hairs into the right eyepiece tube of the binocular tube, aligning the positioning slot ① and positioning pin ②. (Fig. 2)

★ **When the eyepiece positioning pin is inserted into the lower slot on the tube, the cross lines in the eyepiece coincide with the vibration direction of polarizer and analyzer at 0° settings. When inserted into the other slot, the cross lines are at 45° to the direction of vibration. (This is the same with the monocular tube.)**

Then insert the other eyepiece into the left tube.

Fig. 2

2) Looking through the right eyepiece (with cross hairs) with your right eye, rotate the diopter adjustment ring ① until the cross hairs are sharply focused. (Fig. 3)

3) Looking through the both eyepieces with both eyes, adjust the interpupillary distance, sliding the knurled dovetail slides ② of the right and left eyepiece tubes, until perfect binocular vision is obtained.

4) Memorize your interpupillary distance setting by reading the scale ③.

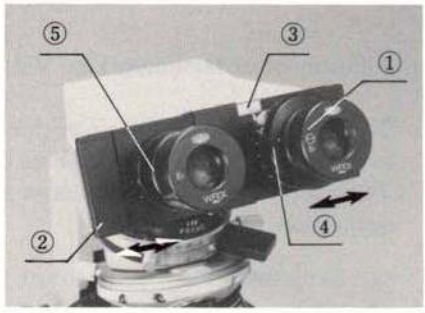


Fig. 3

5) Rotate the tube length adjustment ring ④ on the right eyepiece tube to match your interpupillary distance setting which you obtained from the scale.

6) Look at the image through the right eyepiece with your right eye and focus on the specimen with the coarse and fine adjustment knobs.

7) Look at the image through the left eyepiece with your left eye and rotate the tube length adjustment ring ⑤ to focus on the specimen without using the coarse and fine adjustment knobs.

3. Polarizer Alignment

1) Push the analyzer ① into the light path, and make sure that both polarizer and analyzer are set at position "0" to attain the "Crossed filter" position. Then loosen the clamping screw ② of the condenser. (Fig. 4)

2) Remove the specimen out of the light path so that a transparent area comes into the light path. Keeping the polarizer at the "0" position, rotate the polarizer rotation ring ③ until the optimum extinction is obtained, then clamp the ring. (Fig. 4)

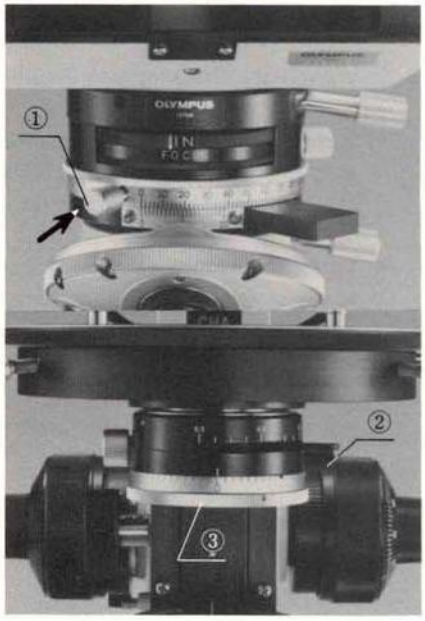


Fig. 4

4. Centering the Stage

1) Looking through the eyepiece and objective 10X, determine some particular point, as you like, in the specimen image and coincide this point with the center of the cross hairs of the eyepiece.

2) Rotating the stage, coincide the center of the rotation of a specimen point with the center of the cross hairs by means of the two centering screws ①. (Fig. 5)

★ **Repeat this procedure until the centration is secured.**

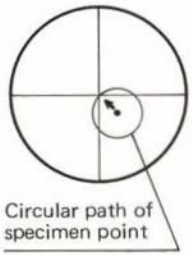


Fig. 5

5. Centering the Objectives

This centration is required for all PO objectives except the objective PO 10X.

1) Insert a centering wrench ① into each centering screw of the nosepiece. (Fig. 6)

2) By means of the two centering wrenches, coincide the center of the cross hairs to the rotation center of the specimen.

3) After all objectives are centered, remove the centering wrenches.

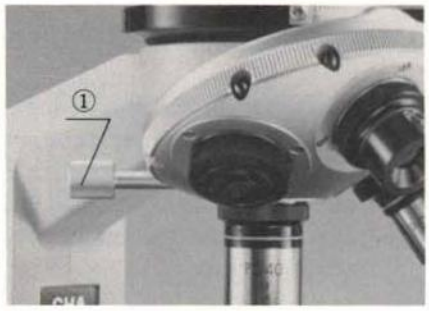
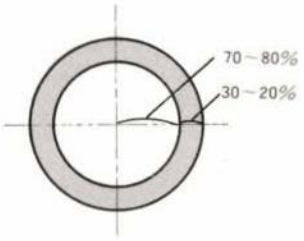


Fig. 6

6. Use of Aperture Iris Diaphragm

Adjust the opening of the aperture iris diaphragm according to various conditions such as the numerical aperture of the objective, image contrast, depth of focus, and flatness of field. Generally it is often preferable to stop down the aperture iris diaphragm to 70% or 80% of the N. A. of the objective.
After the eyepiece is removed from the observation tube, if necessary, look through the observation tube and check the opening of the aperture diaphragm at the objective pupil.



7. Focusing Adjustment

1) Tension adjustment of coarse adjustment knobs

A tension adjustment ring ① is provided next to the right hand coarse adjustment knob. With this device the tension of the coarse adjustment is freely adjustable for either heavy or light movement depending on operator preference. (Fig. 7)

However, do not loosen the tension adjustment ring too much, because the stage drops, or the fine adjustment knobs slip easily.

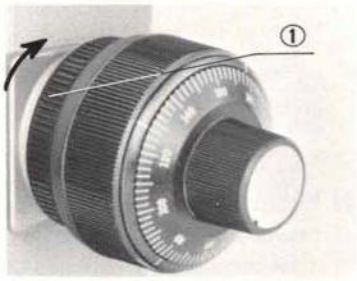


Fig. 7

★ **Be careful not to rotate the right and left coarse adjustment knobs in the opposite directions simultaneously.**

2) Pre-focusing lever

This lever ① is locked after coarse focus has been accomplished. It prevents further upward travel of the stage by means of the coarse adjustment knobs, and automatically provides a limiting stop if the stage is lowered and then raised again. (Fig. 8)

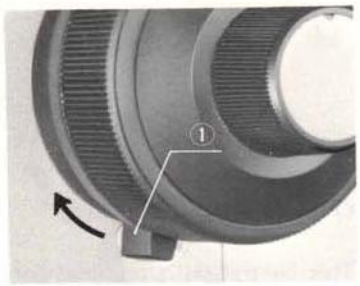


Fig. 8

8. Orthoscopic Observation

1) Swing out the top lens of the condenser.
In principle, polarized light enters the light path parallel to the optical axis, to enable observation of the optical characteristics of the specimen. However, this method will darken the field of view and lower the resolving power of the objective extremely. Therefore, swing out the top lens of the condenser, using only the lower aperture of the lower condenser lens.

2) Insert the analyzer into the light path, and attain crossed filter position with analyzer and polarizer at 0° setting. At this position, the polarizer vibration is in the north-south direction, and the analyzer vibration in the east-west direction. To open the filter position, pull out the analyzer rotation screw.

3) Rotate the stage until extinction of the image is attained.
From this position, rotate the stage by 45° to obtain the diagonal position, at which position, the retardation angle is measured.

4) Insert the quarter wave plate or sensitive tint plate into the slot in the intermediate polarizing tube.

★ A Berek compensator is optionally available to measure the birefringence of a specimen.

Sensitive tint plate

Quarter wave plate

Berek compensator

9. Conoscopic Observation

1) Swing in the top lens of the condenser, and illuminate the specimen with no need to immerse between the condenser and specimen slide.

2) Bring the specimen into focus, rotate the Bertrand lens turret ring into the IN position.

3) Focus on the interference figure formed at the back focal plane of the objective from 20X to 100X.
The pinhole cap provided may be used in place of the eyepiece to directly view the interference figure mentioned above. In this case, the Bertrand lens is disengaged.

VI. OPTICAL DATA

Objective / Eyepiece	Magnification	PO4X	PO10X	PO20X	PO40X	*PO100X
	N. A.	0.10	0.25	0.40	0.65	1.30
	W. D. (mm)	18.77	6.78	1.58	0.61	0.11
	Focal length (mm)	28.45	16.08	8.13	4.33	1.81
	Resolving power (μ)	3.4	1.3	0.84	0.52 (Spring loaded)	0.26 (Spring loaded)
K5X (Field number 21)	Total magnification	20X	50X	100X	200X	500X
	Focal depth (μ)	300.0	48.0	15.56	4.99	1.05
	Field of view (mm)	5.25	2.1	1.05	0.53	0.21
WF10X (18)	Total magnification	40X	100X	200X	400X	1,000X
	Focal depth (μ)	172.5	27.60	9.19	3.03	0.66
	Field of view (mm)	4.5	1.8	0.9	0.45	0.18

* Immersion objective. Resolving power is obtained when the objective is used at full aperture diaphragm.

The eyepieces K5X and WF10X incorporate a sliding eye shield. This shield can be pulled out to prevent glare and loss of contrast caused by ambient light hitting the eye.

○ **W.D. (Working distance):**
The distance between the specimen or cover glass and the nearest point of the objective.

○ **N.A. (Numerical aperture):**
The numerical aperture represents a performance number which could be compared to the relative aperture (f-number) of a camera lens. N.A. values can be used for directly comparing the resolving powers of all types of objectives. The larger N.A., the higher the resolving power.

○ **Resolving power:**
The ability of a lens to register small details. The resolving power of a lens is measured by its ability to separate two points.

○ **Focal depth:**
The distance between the upper and lower limits of sharpness in the image formed by an optical system.

○ **Field number:**
A number that represents the diameter in mm of the image of the field diaphragm that is formed by the lens in front of it.

○ **Field of view diameter:** The actual size of the field of view in mm.

VII. TROUBLESHOOTING

Troubles	Causes	Remedies
1. Optical System		
(a) With the illuminator switched on, the field of view cannot be seen.	The condenser is lowerd excessively.	Raise the condenser to the upper limit.
	Analyzer and polarizer are in the "crossed filter" position ("0:0").	Set them at the position "0:90" or "90:0".
(b) The field of view is cut off or illuminated irregularly.	The nosepiece is not click stopped.	Slightly rotate the nosepiece until it clicks into position.
	The condenser is not correctly mounted on the ring mount.	Re-insert the condenser all the way.
	The sensitive tint plate is stopped midway.	Push the plate all the way until it clicks.
	In case of orthoscopic observation, the condenser top lens stays in the light path or stops midway.	Swing it out of the light path.
(c) Dust or dirt is visible in the field of view.	Dust or dirt on the glass surface at the light exit on the base.	Clean off the dust or dirt.
	Dust on condenser top lens.	
	Dirty specimens.	
	Dust on eyepiece.	
(d) Excessive image contrast.	The condenser is lowered excessively.	Raise the condenser.
	The aperture iris diaphragm is stopped down excessively.	Open the diaphragm.
(e) Resolution problems: ○ Image is not sharp. ○ Insufficient contrast. ○ Image details lack definition.	The objective is not correctly positioned in the light path.	Slightly rotate the nosepiece until it clicks into position.
	Dirt on objective front lens.	Clean the objective.
	The immersion objective is used without immersion oil.	Apply immersion oil.
	Bubbles in the immersion oil.	Remove bubbles.
	The Olympus designated oil is not used.	Use the designated oil.

Troubles	Causes	Remedies
	Dirty specimen.	Clean.
	Dust on condenser lens.	
(f) The field of view is partially out of focus.	The objective is not correctly positioned in the light path.	Slightly rotate the nosepiece until it clicks into position.
	The specimen is not correctly positioned on the stage.	Place the specimen on the stage and secure it with the specimen clips.
(g) The image goes out of focus eccentrically.	The objective is not correctly positioned in the light path.	Slightly rotate the nosepiece until it clicks into position.
(h) When objectives are changed, they are not parfocal.	The mechanical tube length is not correctly adjusted.	Adjust with the tube length adjustment rings on the observation tube.
(i) Light intensity does not increase although the voltage is raised.	The condenser is lowered excessively.	Raise the condenser.
(j) The condenser does not come to the correct position for optimum extinction.	The observation tube and condenser are not correctly mounted.	Re-mount them correctly.
(k) No conoscopic image can be seen.	The condenser top lens is not in the light path.	Swing it in.
(l) The crossed filter position is not attained.	The analyzer is out of the light path.	Push it in.
2. Electric System		
(a) The illuminator is too bright (or too dark).	The rheostat trimmer screw is not matched to the mains voltage.	Adjust the trimmer screw to match the mains voltage.
	The mains voltage is too high (or too low).	Adjust the mains voltage with a variable voltage transformer.
	The rheostat trimmer screw is not correctly adjusted.	Adjust it correctly.
(b) Output voltage for the illuminator cannot be regulated.	The voltage selector switch is not matched to the mains voltage.	Adjust the mains voltage selector switch to the mains voltage.
	The mains voltage is too low or too high.	Adjust the mains voltage with a variable voltage transformer.

Troubles	Causes	Remedies
(c) The light flickers and the intensity is unstable.	The mains voltage is unstable.	Use a variable voltage transformer.
	The filament of the bulb is likely to burn out.	Replace the bulb.
	Loose electrical connection.	Secure the connection.
(d) Fuse burns out too often.	The fuse is not a standard fuse.	Use a standard fuse.
	The voltage selector switch is not matched to the mains voltage.	Match the switch to the mains voltage.
(e) Reduced bulb life.	The voltage selector switch is not matched to the mains voltage.	Match the selector switch to the mains voltage.
	The bulb is not a standard bulb.	Use a standard bulb.
	Mains voltage is too high.	Use variable voltage transformer.
3. Focusing		
(a) Coarse adjustment is too tight.	Tension adjustment ring is tightened too much.	Loosen the tension adjustment ring properly.
	The user is trying to raise the stage over the upper focusing limit imposed by the engaged pre-focusing lever.	Unlock the pre-focusing lever.
(b) The stage drops and the specimen goes out of focus.	The tension adjustment ring is too loose.	Tighten the ring properly.
(c) The stage cannot be raised to the upper limit.	Pre-focusing lever is engaged in lower than focusing position.	Unlock the pre-focusing lever.
(d) The stage cannot be lowered to the lower limit of the working range.	The condenser mount is lowered too much.	Raise the condenser mount.
(e) The objective front lens hits against the specimen.	The specimen is mounted on the stage upside down.	Reverse the specimen.
4. Observation Tube		
(a) Incomplete binocular vision.	Interpupillary distance is not correctly adjusted.	Correct the interpupillary distance.

Troubles	Causes	Remedies
	Diopter adjustment is incomplete.	Complete the diopter adjustment.
	Right and left eyepieces are not matched.	Use pair of matched eyepieces.
	The user is unaccustomed to binocular observation.	Prior to looking at the image of the specimen, try to look at a far away object.
5. Stage		
(a) The image easily goes out of focus when you touch the stage.	The stage is not correctly clamped.	Clamp the stage securely.
(b) The specimen stops midway on the east-west traverse.	The specimen is not correctly positioned on the stage.	Adjust the specimen position.

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